

ORIGINAL ARTICLE

Three new species of eriophyoid mites of the tribe Phyllocoptini Nalepa (Eriophyoidea: Eriophyidae) from Shaanxi, China

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Abstract Three new species of eriophyoid mites from Shaanxi, China are described and illustrated, namely *Leipothrix araliae* sp. nov. infesting *Aralia chinensis* Linn. (Araliaceae), *Calepitimerus akebis* sp. nov. infesting *Akebia trifoliata* (Thunb.) Koidz. (Lardizabalaceae), *Calepitimerus rhus* sp. nov. infesting *Rhus chinensis* Mill. (Anacardiaceae), respectively. All the new species described here are vagrants on the undersurfaces of leaves of the respective host plants.

Key words Eriophyoid mites, Phyllocoptinae, taxonomy, new species.

1 Introduction

D. A. Trotter firstly reported two new species of eriophyoid mites from Shaanxi Province in 1900 (Hong *et al.*, 2010). Then seldom works were done. During 2005 to 2011, Xiaofeng Xue with his group researched the eriophyoid mites from Qinling Mountains. As a result, they reported 130 species of Shaanxi Province (Xue *et al.*, 2012). Since 2009, the author with his group studied on eriophyid species from Shaanxi Province. Up to 2014, about 147 species belonging to 3 families, 7 subfamilies, 12 tribes, 52 genera were reported in Shaanxi Province (Xie, 2013, 2014; Xie *et al.*, 2013; Xue *et al.*, 2012).

There are 30 species reported in Shaanxi under the tribe Phyllocoptini, including 2 species under the genus *Leipothrix* (*L. chimonae* Xie, Hu & Wang, 2012 on *Chimonanthus praecox*; *L. moraceus* Castagnoli, 1980 on *Morus alba*) and 3 species under the genus *Calepitimerus* (*C. dendrobenthamiae* Xue, Song & Hong, 2006 on *Dendrobenthamia japonica*; *C. fopingi* Xue, Song & Hong, 2006 on *Lindera glauca*; *C. taibaicus* Xue, Song & Hong, 2011 on *Ulmus* sp.). In this paper, three new species are identified and described as new to science, namely *Leipothrix araliae* sp. nov., *Calepitimerus akebis* sp. nov. and *Calepitimerus rhus* sp. nov.

2 Materials and methods

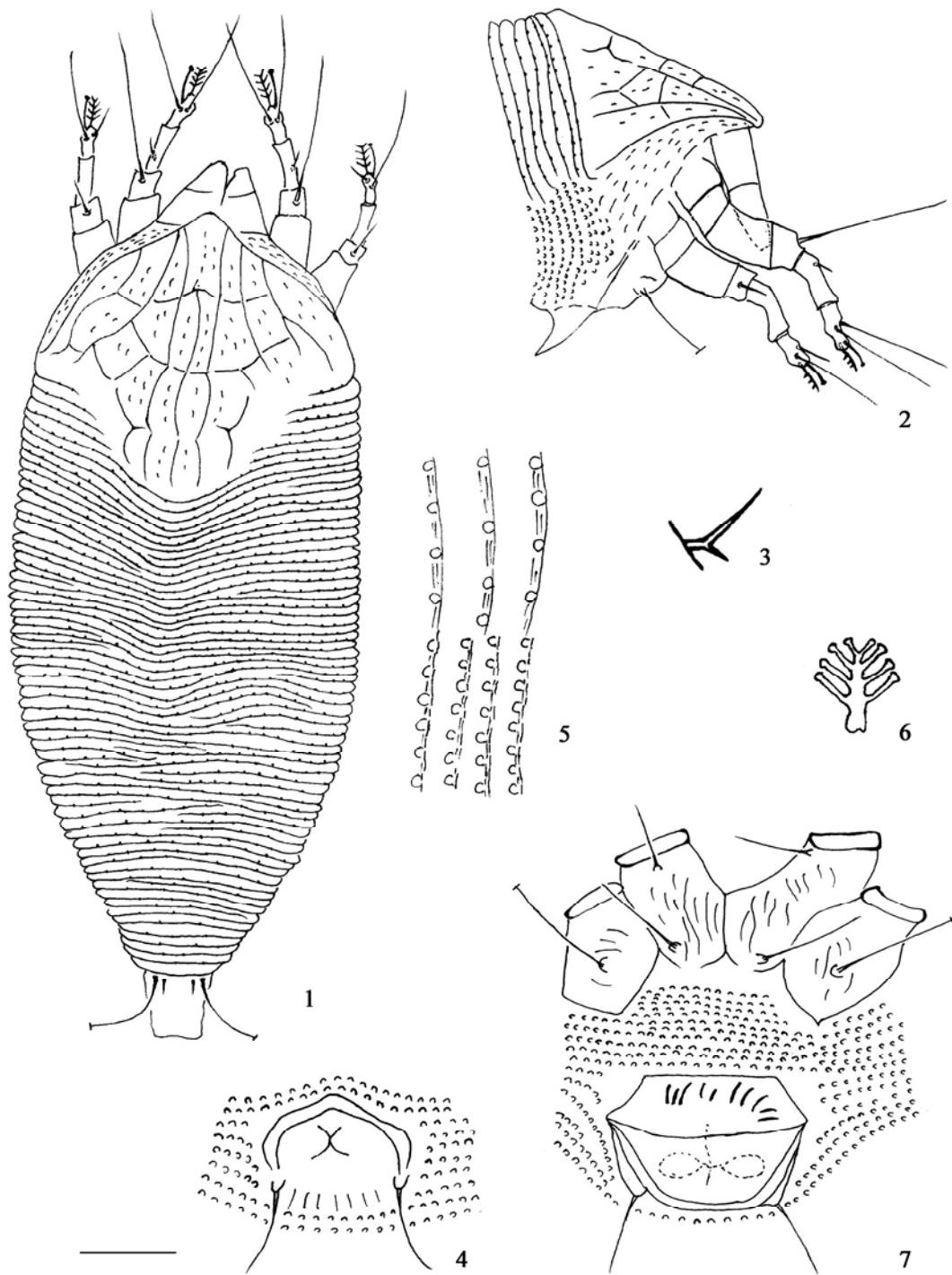
All specimens were collected from the Qinling Mountains, Shaanxi Province from 2008 to 2009. The mites were found on the undersurfaces of host plant leaves with a magnifying glass in the field, and then were collected and preserved in sucrose-ethanol solution (75%). They were cleared and mounted on glass slides according to Kuang (1995). Specimens were measured following Lillo *et al.* (2010). Morphological terminology and generic classification follow Amrine *et al.* (2003).

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Specimens were examined with an Olympus microscope (BX51) and made digital images by a CCD. All measurements are in micrometers (μm) and are lengths when not specified. The range of the paratypes (in brackets) follows the measurements of the holotype. All illustrations were prepared with the software Adobe Photoshop CS 8.0®. Type specimens are deposited in College of Agriculture and Life Science, Ankang University, Ankang City, Shaanxi, China.



Figures 1–7. *Leipothrix araliae* sp. nov. 1. Female, dorsal view. 2. Female, antero-lateral view. 3. Dorsal pedipalp genual setae *d*. 4. Male, genital region. 5. Female opisthosoma (enlarged), lateral view. 6. Empodium enlarged. 7. Female, coxal-genital region. Scale bars: 1=17 μm ; 2=15 μm ; 4, 7=10 μm .

3 Taxonomy

3.1 Genus *Leipothrix* Keifer, 1966

Leipothrix Keifer, 1966, *Eriophyid mites*, B19: 1.
Type species: *Leipothrix solidaginis* Keifer, 1966.

Leipothrix araliae sp. nov. (Figs 1–7)

Female ($n=7$). Body fusiform, 163 (163–218) long, 65 (64–75) wide, 60 (49–80) thick, yellowish. Gnathosoma 25 (25–28) long, projecting down; dorsal pedipalp genual setae (*d*) 13 (13–15), bifurcate at about 1/4 from base. Prodorsal shield 56 (54–57) long, 68 (57–68) wide, with a smaller frontal lobe; shield surface sculptured with dashes; median line nearly complete except faint at anterior 1/4; admedian lines complete, subparallel; submedian lines curved; a few lines crossing with median, admedian and submedian lines and forming 4–6 networks at the middle of shield. Scapular tubercles set ahead of rear shield margin, 20 (18–20) apart; scapular setae (*sc*) 3 (3–4), projecting up and centrad. Coxisternal plates I and II sculptured with lines, prosternal apodeme 7 (6–7); anterolateral setae on coxisternum I (*1b*) 8 (7–8), 13 (12–13) apart; proximal setae on coxisternum I (*1a*) 10 (10–12), 8 (7–8) apart; proximal setae on coxisternum II (*2a*) 25 (25–26), 25 (25–30) apart. Legs with all setae except femoral setae; Leg I 34 (30–35), trochanter 2 (2–3); femur 10 (9–10); genu 5 (4–5), antaxial genual setae (*I''*) 30 (25–34); tibia 10 (9–10), paraxial tibial setae (*I'*) 2 (2–3), located at lateral 1/3 from base; tarsus 7 (6–7), both paraxial fastigial tarsal setae (*ft'*) and antaxial fastigial tarsal setae (*ft''*) 20 (18–20); tarsal solenidion 5 (5–6), knobbed; tarsal empodium 4-rayed, entired. Leg II 31 (30–35), trochanter 2 (2–3); femur 9 (9–10); genu 4 (4–5), antaxial genual setae (*I''*) 7 (5–8); tibia 10 (9–10); tarsus 6 (6–7), paraxial fastigial tarsal setae (*ft'*) 5 (5–6), antaxial fastigial tarsal setae (*ft''*) 20 (18–20); tarsal solenidion 5 (5–6), knobbed; tarsal empodium 4-rayed, entired. Opisthosoma with dorsal annuli 60 (58–62), of which 27–30 dorsal annuli forming a longitudinal median ridge, round microtubercles ornamented dorsal annuli; ventral annuli 71 (71–75), with round microtubercles except caudal 6 ventral annuli with elongated microtubercles. Setae *c2* 17 (17–20), 63 (60–63) apart, on 13–14th ventral annulus; setae *d* 20 (20–25), 52 (51–52) apart, on 26–27th ventral annulus; setae *e* 10 (10–12), 17 (16–17) apart, on 50–51st ventral annulus; setae *f* 25 (20–25), 20 (20–22) apart, on 7th ventral annulus from rear. Setae *h1* 3 (2–3), setae *h2* 65 (60–70). Female genital coverflap 15 (15–17) long, 22 (20–22) wide, with basal 10–12 longitudinal lines and terminal smooth, proximal setae on coxisternum III (*3a*) 9 (9–10), 15 (15–16) apart.

Male ($n=2$). Body 130–158 long, 50–58 wide; genitalia 15–16 wide, genitalia area ornamented with several lines; proximal setae on coxisternum III (*3a*) 8–10, 13–15 apart.

Material examined. Holotype, female, Muwang Forest Park, Yangsi (33°26'N, 108°39'E; elev. 1 400 m), Zhen'an, Shaanxi, China, 7 August 2008, from *Aralia chinensis* Linn. (Araliaceae), coll. Manchao Xie. Paratypes, six females and two males, the same data as the holotype.

Biology. The mites are vagrant on the undersurfaces of leaves. No obvious damage to the host plant was seen.

Etymology. The specific designation *araliae* is derived from the generic name of the type host plant, gender feminine.

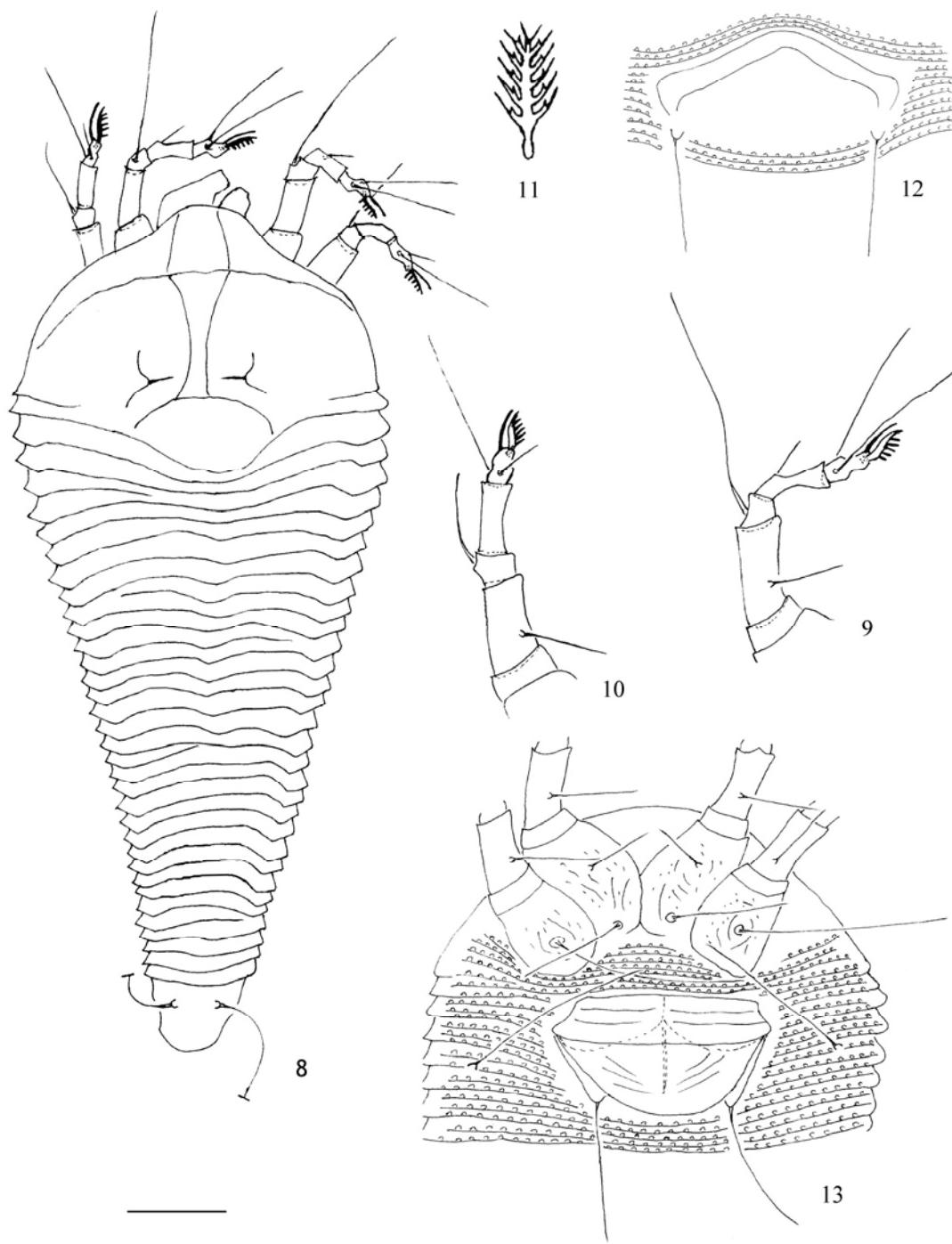
Remarks. This new species is similar to *L. moraceus* Castagnoli, 1980 by the prodorsal shield design and the same distribution in Qinling Mountains. But in *L. araliae* sp. nov., shield surface is sculptured with dashes, and female genital coverflap is ornamented with basal 10–12 longitudinal lines. While in *L. moraceus*, shield surface is absent dashes, and female genital coverflap is ornamented with granular basally.

3.2 Genus *Calepitrimerus* Keifer, 1938

Calepitrimerus Keifer, 1938, *Eriophyid mites*, 2: 310.
Type species: *Calepitrimerus cariniferus* Keifer, 1938.

Calepitrimerus akebis sp. nov. (Figs 8–13)

Female ($n=7$). Body fusiform, flat, 175 (130–188) long, 72 (60–72) wide, whitish. Gnathosoma 20 (18–20) long, projecting down; dorsal pedipalp genual setae (*d*) 6 (6–7). Prodorsal shield 54 (40–55) long, 66 (58–66) wide, with a moderate frontal lobe; shield surface covered with sheet waxiness; median and submedian lines absent; admedian lines nearly complete except about 1/4 part at rear; there are two arc-shaped lines intersecting with admedian lines at anterior 1/4 and rear 1/4. Scapular tubercles set ahead of rear shield margin, 16 (15–18) apart; scapular setae (*sc*) 5 (5), projecting up and centrad. Coxisternal plates I and II sculptured with lines and granules, prosternal apodeme 5 (5–6); anterolateral setae on coxisternum I (*1b*) 6 (6–8), 12 (11–13) apart; proximal setae on coxisternum I (*1a*) 13 (12–13), 6 (6–7) apart;



Figures 8–13. *Calepitrimerus akebis* sp. nov. 8. Female, dorsal view. 9. Leg I. 10. Leg II. 11. Empodium enlarged. 12. Male, genital region. 13. Female, coxal-genital region. Scale bars: 8=18 µm; 9–10=12 µm; 12=8 µm; 13=10 µm.

proximal setae on coxisternum II (2a) 23 (20–25), 20 (20–25) apart. Leg I 34 (31–36), trochanter 2 (2–3), femur 12 (11–12), basiventral femoral setae (bv) 10 (7–10); genu 5 (4–5), antaxial genual setae (l") 30 (30–34); tibia 10 (9–10), paraxial tibial setae (l') 5 (4–5), located at lateral 1/3 from base; tarsus 5 (5–6), both paraxial fastigial tarsal setae (ft') and antaxial fastigial tarsal setae (ft") 20 (20–23); tarsal solenidion 7 (7), unknobbed; tarsal empodium 6-rayed, entired. Leg II 32 (30–35), trochanter 2 (2–3); femur 11 (11–12), basiventral femoral setae (bv) 11 (9–11); genu 5 (4–5), antaxial genual setae (l") 12 (12–15); tibia 9 (8–9); tarsus 5 (5–6), praxial fastigial tarsal setae (ft') 5 (5–7), antaxial fastigial tarsal setae (ft") 20 (20–23); tarsal solenidion 7 (7), unknobbed; tarsal empodium 6-rayed, entired. Opisthosoma with dorsal annuli 32 (30–35), dorsal annuli covered with wool-like waxiness. Among them, 16–19 dorsal annuli forming a median longitudinal ridge and 25–27 dorsal annuli forming two lateral longitudinal ridges; ventral annuli 55 (55–65), round

microtubercles ornamented ventral annuli except caudal 6 ventral annuli with elongated microtubercles. Setae *c2* 21 (20–23), 54 (40–54) apart, on 12–13rd ventral annulus; setae *d* 40 (30–40), 33 (30–33) apart, on 23–24th ventral annulus; setae *e* 25 (23–25), 17 (17–18) apart, on 40–41st ventral annulus; setae *f* 30 (30–37), 18 (18–25) apart, on 6th ventral annulus from rear. Setae *h1* absent; setae *h2* 30 (30–40). Female genital coverflap 15 (14–16) long, 24 (20–24) wide, with basal transverse lines and terminal 6 oblique lines, proximal setae on coxisternum III (3a) 15 (15–17), 16 (15–19) apart.

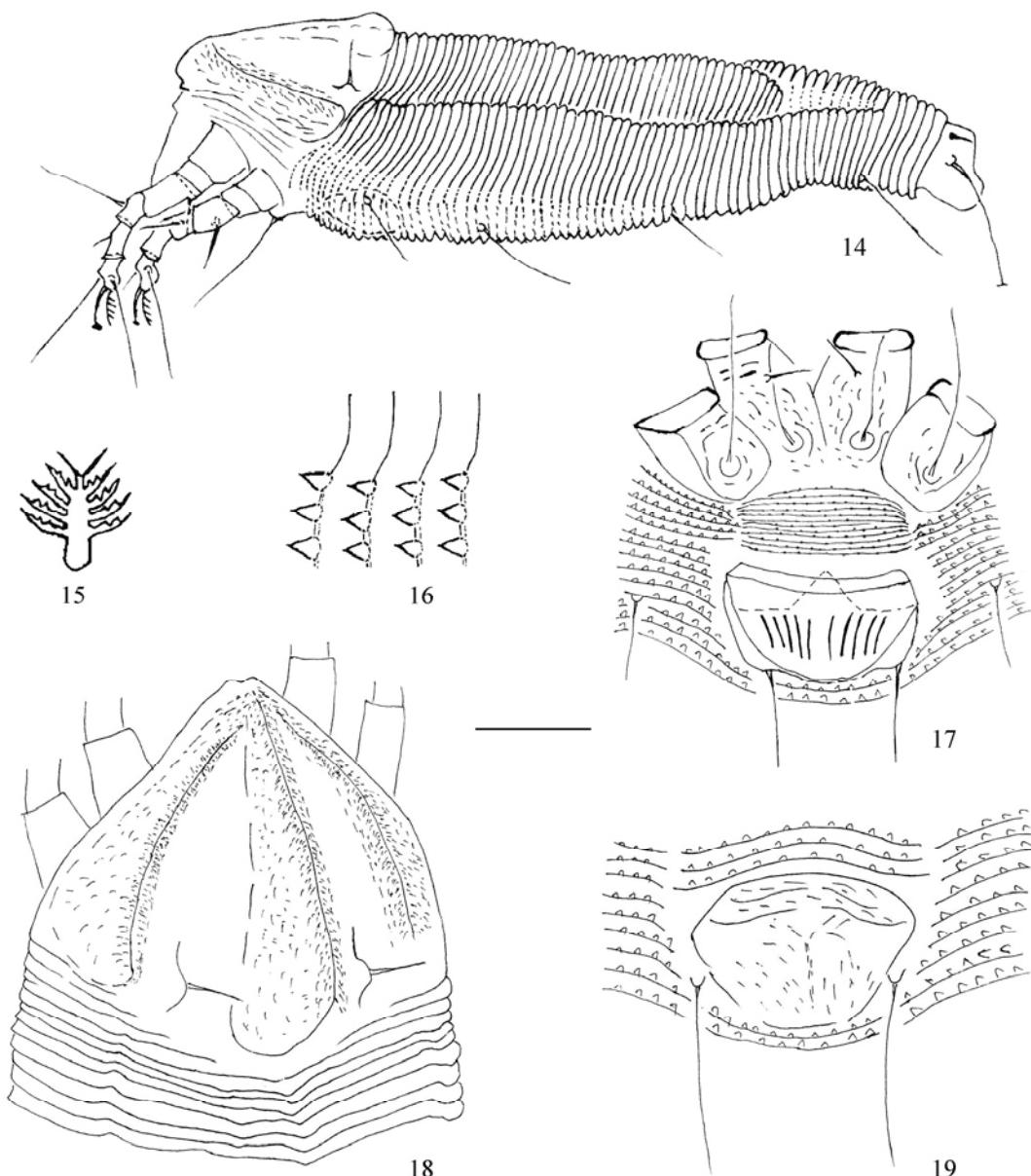
Male (*n*=1). Body 118 long, 50 wide; genitalia 20 wide, proximal setae on coxisternum III (3a) 10, 15 apart.

Material examined. Holotype, female, Shangzhu (31°54'N, 109°25'E; elev. 960m), Zhenping, Shaanxi, China, 21 July 2009, from *Akebia trifoliata* (Thunb.) Koidz. (Lardizabalaceae), coll. Man-Chao Xie. Paratypes, six females and one male, the same data as the holotype.

Biology. The mites are vagrant on the undersurfaces of leaves. No obvious damage to the host plant was seen.

Etymology. The specific designation *akebis* is derived from the generic name of the type host plant, gender masculine.

Remarks. This new species is similar to *C. antedesmae* Chakrabarti & Das, 1982 by the prodorsal shield design, but can be separated from the latter as follows. In *C. akebis* sp. nov., shield median line is absent, and female genital coverflap



Figures 14–19. *Calepitrimerus rhus* sp. nov. 14. Female, lateral view. 15. Empodium enlarged. 16. Female opisthosoma (enlarged), lateral view. 17. Female, coxal-genital region. 18. Female, antero-dorsal view. 19. Male, genital region. Scale bars: 14=24 µm; 17–18=13 µm; 19=6 µm.

is ornamented with terminal lines, and tarsal empodium is 6-rayed. But in *C. antedesmae*, shield median line is present, female genital coverflap is ornamented with terminal granules, and tarsal empodium is 5-rayed.

Calepitrimerus rhus sp. nov. (Figs 14–19)

Female ($n=8$). Body fusiform, 180 (125–200) long, 52 (50–60) wide, 45 (39–58) thick, yellowish. Gnathosoma 24 (18–25) long, projecting down; dorsal pedipalp genual setae (*d*) 5 (5). Prodorsal shield 44 (39–45) long, 49 (46–50) wide, with a thickening frontal lobe overhanging the root of gnathosoma; shield design with both the edge and central area of shield elevated, and two grooves following. Scapular tubercles set ahead of rear shield margin and lie to the grooves, 20 (20–23) apart; scapular setae (*sc*) 7 (6–10), projecting centrad. Coxisternal plates I and II sculptured with lines and granules, prosternal apodeme 6 (6–7); anterolateral setae on coxisternum I (*1b*) 5 (5–6), 11 (10–11) apart; proximal setae on coxisternum I (*1a*) 13 (10–20), 6 (6–7) apart; proximal setae on coxisternum II (*2a*) 22 (20–30), 20 (20–23) apart. Leg I 29 (24–32), trochanter 2 (2–3); femur 10 (8–12), basiventral femoral setae (*bv*) 6 (6–8); genu 5 (4–5), antaxial genual setae (*l''*) 18 (15–18); tibia 6 (5–6), paraxial tibial setae (*l'*) 5 (4–6), located at lateral 1/2 from base; tarsus 6 (5–6), both paraxial fastigial tarsal setae (*ft'*) and antaxial fastigial tarsal setae (*ft''*) 20 (20–22); tarsal solenidion 7 (7), knobbed; tarsal empodium 5-rayed, entired. Leg II 28 (23–30), trochanter 2 (2–3); femur 10 (8–10), basiventral femoral setae (*bv*) 8 (7–8); genu 4 (4–5), antaxial genual setae (*l''*) 6 (6–7); tibia 6 (4–6); tarsus 6 (5–6), praxial fastigial tarsal setae (*ft'*) 6 (5–7), antaxial fastigial tarsal setae (*ft''*) 20 (20–22); tarsal solenidion 7 (7), knobbed; tarsal empodium 5-rayed, entired. Opisthosoma with dorsal annuli 65 (63–69), of which 58–63 dorsal annuli forming two lateral longitudinal ridges and 46–48 dorsal annuli forming a median longitudinal ridge. Between the lateral ridges and the median ridge, there are two longitudinal grooves extending to the caudal opisthosoma; ventral annuli 74 (74–78), irregular microtubercles ornamented ventral annuli except caudal 6 ventral annuli with elongated microtubercles. Setae *c2* 12 (10–15), 42 (35–42) apart, on 12nd ventral annulus; setae *d* 20 (17–30), 28 (25–30) apart, on 24th ventral annulus; setae *e* 15 (15–22), 12 (12–13) apart, on 44th ventral annulus; setae *f* 20 (20–30), 17 (13–17) apart, on 7th ventral annulus from rear. Setae *h1* 3 (2–3); setae *h2* 30 (25–30). Female genital coverflap 13 (13–15) long, 20 (20–23) wide, sculptured with 10 (8–10) ridges, proximal setae on coxisternum III (*3a*) 12 (12–15), 15 (13–15) apart.

Male ($n=1$). Body 125 long, 35 wide; genitalia 12 wide, proximal setae on coxisternum III (*3a*) 10, 10 apart.

Material examined. Holotype, female, Xiangxidong cenic spot (32°40'N, 109°18'E; elev. 340 m), Ankang, Shaanxi, China, 9 September 2008, from *Rhus chinensis* Mill. (Anacardiaceae), coll. Manchao Xie. Paratypes. seven females and one male, the same data as the holotype.

Biology. The mites are vagrant on the undersurfaces of leaves, and some white spots on the surface of leaves occur.

Etymology. The specific designation *rhus* is derived from the generic name of the type host plant, gender masculine.

Remarks. This new species is similar to *C. ceriferaphagus* Cromroy, 1987 with central area of shield elevated, but can be separated from the latter as follows. In *C. rhus* sp. nov., there are two grooves on the shield, tarsal empodium is 5-rayed, and body annuli is subequal dorsoventrally (holotype 65 dorsal annuli contrast to 74 ventral annuli). But in *C. ceriferaphagus*, shield design has one groove, tarsal empodium is 4-rayed, and dorsoventral annuli distinct difference from each other (holotype 37 dorsal annuli contrast to 56 ventral annuli).

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